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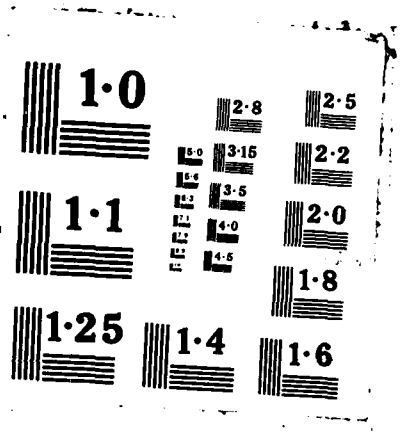
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Digital Topographic Support System

(DTSS)

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ABSTRACT

The Digital Topographic Support System (DTSS), scheduled for fielding in 1991, will provide automated capabilities to the Army Terrain Teams. DTSS will exploit digital terrain data to generate terrain analysis products and supply digital terrain data to other Army systems. Army terrain analyst will be able to store, revise, update and create digital terrain data to supplement digital data received from the Defense Mapping Agency. The Required Operational Capability (ROC) was approved in October 1986. Approval to proceed with Full Scale Engineering Development (FSED) was granted in June 1987 and followed by award of the FSED contract in July 1987.

INTRODUCTION

The battlefield of the future will be a fast changing arena in which rapid decisions on the conduct of battle will be needed. Anticipation and quick reaction to enemy movement near and well behind the line of conflict will be required to off-set superior numbers of troops. Each unit supporting the commander must have the capability of providing quick analysis and products in order to give friendly forces the edge in combat. The Army has initiated modernization efforts in each area which contribute to the conduct of battle. The Digital Topographic Support System (DTSS) is one system being developed to modernize the Army Engineer Terrain Analysis Teams.

The environment - terrain and weather - has long been recognized as a major factor in the conduct of battle. The Army Engineer Terrain Analysts (TA) are currently supporting the commander with information and products which relate the impact of terrain and weather on the terrain on the execution of battle. The TA's are accomplishing their assigned task using manual methods which have not changed much in the past 20 years. Terrain factors - drainage, slope, vegetation, lines-of-

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communication, obstacles and soils - are being collected manually and recorded on Mylar overlays from all available sources to form a data base. The Defense Mapping Agency's (DMA) Tactical Terrain Analysis Data Base (TTADB) and Planning Terrain Analysis Data Base (PTADB), both cartographic products, have augmented the TA's own data base for limited areas of the world. Synthesized products (mobility, concealment, avenues-of-approach, river crossing, etc.) are produced using analytical models and overlays which are a combination of all the factors required to produce the product. To date the modernization of the TA's function consist of hand-held calculators and the MICROFIX-T. Both have proven to be effective tools for the TA's. Recently the capability to exploit DMA's Digital Terrain Elevation Data (DTED) has been added to the MICROFIX-T allowing the TA to perform line-of-sight analysis in less time than the previously used manual methods.

Even with MICROFIX, the time for the TA's to produce hardcopy terrain analysis products continues to be days and weeks. The "customers" the TA's support are developing computer-based systems which require and use digital data. The TA's "customers" will need responses in minutes and hours as well as products in digital form in order to conduct their function in time of battle. There is also the potential need for the TA to provide a customer-oriented digital terrain data base.

DIGITAL TOPOGRAPHIC SUPPORT SYSTEM

The Digital Topographic Support System (DTSS) is being developed to answer the need to modernize the TA's tasks. The need for DTSS was first formalized in a Letter of Agreement in 1982. The operational capabilities for DTSS were approved by the Training and Doctrine Command (TRADOC) and the Army Materiel Command (AMC) in October 1986. The DTSS will be a tactical, computer-based system which will allow TA's to create, revise, update and manipulate digital terrain data to produce terrain analysis products which contribute to the Intelligence Preparation of the Battlefield (IPB) and to support other tactical systems with digital terrain data and products. The system will be housed in a standard S-280 shelter mounted on a standard 5-ton military truck. A 30KW generator, trailered behind the DTSS, will provide the required power for the system.

Program Management

The Joint Tactical Fusion Program Office (JTFPO) recognized the need for digital terrain analysis support from DTSS for

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the All Source Analysis System (ASAS) which JTFPO is developing. Because of the close association of DTSS and ASAS and the need for the development of the two systems to track together, the program management was transferred from the Troop Support Command (TROSCOM) to JTFPO in September 1986. The day-to-day technical management of the DTSS program continues to be performed by the U.S. Army Engineer Topographic Laboratories (USAETL).

Digital Terrain Data

The primary source of digital terrain data for the DTSS will be DMA. The DTSS will make use of the Digital Feature Analysis Data (DFAD) and DTED currently available from DMA. These data do not meet the total needs of the TA. The Army has expressed its need for a more detailed terrain analysis data base, Tactical Terrain Data (TTD), and DMA has recognized this need. TTD will be the data base for the DTSS. The DTSS will allow the TA to update and revise the TTD as man changes the terrain during the conduct of battle or for other reasons. In areas where TTD does not exist, the DTSS will have the capability to create a digital terrain data base. Existing hardcopy terrain analysis sources such as the TTADB's, the PTADB's and the TA's own collection of data will be used to create the digital data base. In areas where no previous analysis has been completed, digital data will be collected from imagery, maps and text.

DTSS Hardware

The DTSS program objective has been development of minimum hardware through the use of ruggedized computer equipment already or soon to be in the Army inventory. This approach would cut expenses not only in hardware development but also documentation, Integrated Logistics, a portion of the training development costs and other costs related to hardware. The DTSS system will consist of a dual monitor work station with its own computational power, internal memory and mass storage; a main processor, mass storage of 960 MBytes or more, a magnetic tape unit, digitizing hardware, a plotter and video disk. Communications equipment, 30KW generator, NBC filters and ECU units are also included in the DTSS hardware configuration. Storage for maps, survival suits, data tapes and other necessary material are required in the integrated shelter.

The ASAS Program is developing hardware which meets the needs of the DTSS. A contract for a ruggedized VAX 8250 has been awarded and has potential for the DTSS main process. The ASAS work station, the Portable ASAS Work Station (PAWS)

has been developed and is in the process of being Type Classified. The PAWS hardware more than meets the needs of the hardware required for the DTSS work station. The PAWS hardware has been TEMPESTed and ruggedized. A ruggedized MICROVAX II with up to 16 MBytes of internal memory and VMS operating system, two ruggedized 360 MByte removable Winchester disk drives, color monitors with excellent graphics and image capability, a work surface, video disk and graphics controller have been configured into five transit cases which are assembled to form the PAWS. Currently the only potential change to the PAWS hardware will be the removal from the transit cases and rack mounting the hardware in the DTSS shelter.

With the exception of the digitizing capability and the plotter, the other equipment mentioned previously will come from the Army inventory. Ruggedized digitizing hardware and ruggedized plotters are not currently in the Government's inventory. While such equipment will be used by ASAS, the ASAS schedule calls for development after the DTSS requires the hardware. For this reason, the development of these two pieces of hardware will be accomplished by the DTSS program.

While the DTSS hardware has its origin in the ASAS program, it will be configured and integrated into a system designed to accomplish automated terrain analysis tasks. When the hardware is integrated into the shelter, Human Factor considerations will focus on the TA's tasks, the work flow and the space and material required.

DTSS Software

The DTSS development is primarily a software development effort. The DTSS software will be designed specifically for the TA. This will be accomplished using a Man-Machine Interface (MMI) designed around the terrain analysis tasks while considering the influence of automation. The MMI will allow the TA to communicate with the Geographic Information System (GIS), terrain analysis and environmental effects applications software, a word processing package and a Special Purpose Product Builder (SPPB) in terms common to his job. Through the MMI, the applications software consisting of standard terrain analysis products identified in FM 21-33, FM 5-105, FM 30-10, STP 5-81Q1-SM and STP 5-81Q2/3/4SM-TG will process the digital terrain data using the GIS software capabilities of the DTSS. Special products of the TA's own design can be produced using the PPB capability to manipulate digital data using the GIS while the MMI keeps the instructions of the GIS invisible to the TA. The DTSS software will also include environmental effects and

historical climatology models. Terrain analysis software models, environmental effects models and historical climatology models developed at USAETL will serve as the basis for the DTSS software.

With the MMI serving as the top level of the software communicating with the TA in terms he understands, the applications software, the SPPB and the GIS form the underlying tools which perform the computations and data manipulations which produce the terrain analysis and environmental effects products. The applications software is based on the analytical models and methods currently used by the TA to generate the products required from him. This software utilizes the GIS to select from the data base those terrain attributes which are required by the specific model being used. This automated process performs the same complexing task currently performed manually by the TA but in significantly shorter times. The analytical model is then applied to the complexed data base producing a new attribute (i e, speed, percent concealment, crossing potential, etc.) for each unique area of terrain. A graphics presentation of the calculated attributes can be displayed on the monitors or plotted on paper or Mylar.

The SPPB will guide the TA enabling him to design products which are not included in the applications software. By using terms he is familiar with, requests will be made by the SPPB to the GIS to extract the information from the data base. Based on the TA's response to SPPB inquires the GIS will form the desired product and display the product for his review.

The GIS will be the work horse of the DTSS software. Data manipulation, and data base updating, revision and creation will be handled by the GIS. The GIS addresses the terrain attributes, assess the area of coverage, extracts the attributes being sought and performs the manipulation needed to form the graphics to display the terrain information requested or created. The Boolean operations used to complex terrain attributes to form the data base required by the specific applications model are performed by the GIS. The GIS also manages the data files for quick reference. The GIS selected by the DTSS Full Scale Engineering Development contractor is ARC-INFO, a commerical GIS developed by the Environmental Systems Research Institute.

Program Status

A paper DTSS Milestone In-Process Review (MII IPR) was completed in June 1987 when unconditional concurrence was

obtained from the voting members of the DTSS MII IPR board, JTFPO, TRADOC and the Logistics and Evaluation Agency (LEA). The recommendation to proceed to Full Scale Engineering Development (FSED) was forwarded to the Acquisition Approval Authority, BG Harmon on 5 June 1987. Approval to proceed to FSED was granted by BG Harmon on 25 June 1987 in the System Acquisition Decision Memorandum.

FSED contract proposals were received from eight offers. The number of offers was reduced to two companies after an extensive and thorough evaluation. Award was made based on the Best And Final Offers of the two companies. The LORAL System Group (formerly Goodyear Aerospace Corporation) of Akron, Ohio won the 36 month DTSS FSED contract. The award date of the contract was 29 July 1987. The cost of the contract is $8.7 million. Key milestones of the contact are a Hardware/Software Critical Design Review (CDR) in February 1988, a second Software CDR in April 1988, completion of hardware integration and the start of testing in January 1989, and completion of contract in July 1990.

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